

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024
Number 3027, 12 pp., 6 figures
November 26, 1991

The Lizard Genus *Sphenomorphus* (Scincidae) in Panama, with Description of a New Species

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ABSTRACT

Greer assigned three species of Middle American skinks to the otherwise Indo-Australian *Sphenomorphus*, a plesiomorphic taxon. *Sphenomorphus rarus*, new species, extends the New World range of the genus southeastward to the end of the Cordillera de Talamanca in western Panama. The new species is based on a specimen from 780 m in lower montane rain forest. It is most similar to *S. cherriei* (Cope) but is readily diagnosed by diverse characters of scutellation, pha-

langeal formulae, and male genitalia. *Sphenomorphus cherriei* is a widespread skink found at the southern limits of its range on the Pacific lowlands of extreme western Panama. A small juvenile from the Atlantic lowlands also is reported, although its assignment to *cherriei* is provisional since it falls somewhat outside the range of variation of nearly 300 Costa Rican and western Panamanian specimens examined.

RESUMEN

Greer asignó tres especies de escíncidos mesoamericanos a *Sphenomorphus*, un género plesiomórfico por otra parte de la región indo-australiana. *Sphenomorphus rarus*, especie nueva, extiende la distribución del género en el Nuevo Mundo hacia el sudeste hasta el final de la Cordillera de Talamanca en el occidente de Panamá. La especie nueva se basa en un espécimen de los

780 metros de altitud en la selva pluvial montana baja. Esta especie es más parecida a *S. cherriei* (Cope) pero parecer a ser diagnóstica fácilmente por caracteres diversos de las escamas, fórmulas de las falanges, y de los genitales masculinos. *Sphenomorphus cherriei*, un escíncido ampliamente distribuido en América Central, tiene su límite de distribución en las tierras bajas del Pa-

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cífico al oeste extremo de Panamá. Una lagartija juvenil y muy pequeña de las tierras bajas del Caribe se presenta también aquí, aunque su asignación a la especie *cherriei* es provisional porque cae

algo fuera del intervalo de variación de casi 300 especímenes examinados de Costa Rica y Panamá occidental.

INTRODUCTION

The Middle American herpetofauna includes three seemingly related small skinks (*assatus*, *cherriei*, *incertus*) that until recently were referred to the genera *Lygosoma* (e.g., Stuart, 1940), *Scincella* (e.g., Smith and Taylor, 1950), or *Leiolopisma* (e.g., Taylor, 1956; Stuart, 1963; Peters and Donoso-Barros, 1970).

Greer (1974: 32–34) removed these genera from consideration and boldly transferred *assatus*, *cherriei*, and *incertus* into *Sphenomorphus*—a genus otherwise occurring “from southern and eastern Asia through the Indo-Australian Archipelago to the Solomon Islands and Australia” (Greer, 1979: 323). Villa et al. (1988) used this generic arrangement but did not cite Greer in their “Bibliographic Checklist”—an omission which apparently caused them to add a fourth New World species, “*Sphenomorphus*” *gemmingeri* (Cope), an unintentional new combination for a Mexican species that Greer (1974: 32) had placed in *Scincella*.

In any case, zoogeographic conclusions must not yet be drawn from the New World distribution because *Sphenomorphus* is a plesiomorphic taxon not at present definable by derived characters. It is a taxonomically “residual group” (Greer, 1979: 322) of over 120 species; it serves as a convenient repository for the New World (and other) species pending further phylogenetic analysis.

The purposes of the present paper are to describe a fourth species of *Sphenomorphus* (fig. 1), from the southern end of the New World range, and to document the occurrence of *S. cherriei* in Panama.

Sphenomorphus rarus, new species

Figures 1–3, 4A

HOLOTYPE: AMNH 129836 (field no. CWM 17250), an adult male caught by C. W. Myers in company with J. W. Daly on January 13, 1983, in lower montane rain forest on the

southwestern headwaters of the Río Guabo, 780 m elev. (8°47'N, 82°11'W), Province of Bocas del Toro, western Panama.

ETYMOLOGY: The species name is a Latin adjective alluding to the rarity of this new lizard, known from a single specimen.

DIAGNOSIS: A short-limbed New World *Sphenomorphus* (sensu Greer, 1979) lacking supranasals and prefrontals, with single large frontoparietal, single loreal, median pair of nuchal scales not enlarged, median pair of preanal scales enlarged, low number (≈ 26) of rows of smooth scales at midbody, with a median window (palpebral disk) in lower eyelid, and with phalangeal formulae of 2-3-4-4-3/2-3-4-5-3. The several New World species of *Scincella* (sensu Greer, 1974: 32), which occur in Mexico and the United States, are most easily separated from New World *Sphenomorphus* by the presence of paired frontoparietals.

Sphenomorphus rarus appears to be readily distinguished from all its New World congeners (as well as from New World *Scincella*, see above) in lacking prefrontal plates, and in having the frontonasal plate markedly concave posteriorly and in broad contact (owing to absence of prefrontals) with the frontal (fig. 2).

Sphenomorphus rarus is additionally distinguishable from Costa Rican and Panamanian populations of its geographically closest relative, *S. cherriei*, in having (1) fewer subdigital lamellae on the fourth toe (11 in *rarus* vs. 13–18 in *cherriei*), (2) fewer midbody scale rows (26 in *rarus* vs. 29–32 in *cherriei*), and (3) shorter limbs (digits of adpressed limbs widely separated by ≈ 10 scales in adult δ *rarus*, digits usually approaching to within a few scales or actually touching or greatly overlapping in *cherriei*). The type specimen of *rarus* further differs from the great majority of *cherriei* specimens in having a single median window in the lower eyelid, and in having one rather than two loreals.

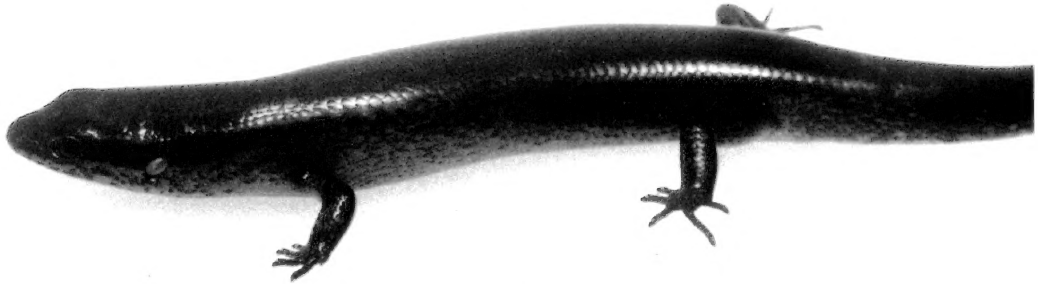


Fig. 1. *Sphenomorphus rarus*, new species. The holotype (AMNH 129836) in life, approximately $\times 2$.

There also are differences in phalangeal formulae and hemipenes—see Comparisons for further discussion and for practical differentiation from other Panamanian skinks or skinklike lizards.

DESCRIPTION OF HOLOTYPE

The undissected holotype is a male, apparently adult, with everted hemipenes. Length from tip of snout to vent (SVL) 52 mm; snout to eye 3.2 mm; snout to ear 9.0 mm; snout to base of forearm 17 mm; trunk length from axilla to groin 27 mm; greatest head width (between angles of jaws) 7.2 mm; greatest body width 9.0 mm. Tail partly regenerated, 49 mm in length (total length 101 + mm). Limbs pentadactyl (5th toe of left forelimb missing due to injury) and short, well separated by space of 10 scales when adpressed against body; straightened limbs measuring (from insertion to tip of longest digit) about 9 mm forelimb (17.3% SVL), 15 mm hind limb (28.8% SVL).

Snout rounded in dorsal and lateral aspect. Rostral twice as wide as high, in broad contact with frontonasal posteriorly. Frontonasal wider than long, with posterior margin broadly and conspicuously concave. Prefrontals absent. Frontal longer than wide. Frontoparietal single, the largest plate on head. Four large supraoculars on each side. Interparietal relatively small, triangular; pineal eye poorly defined, situated in posterior half of interparietal. Parietals much wider than long, in contact behind interparietal, laterally in contact with upper secondary temporal. A

pair of slightly enlarged dorsolateral nuchals, separated by two small undifferentiated nuchals situated posterior to interparietal suture. Minute tubercles (presumed sensory organs) present on anterior head plates, being most numerous on rostral, frontonasal, and supralabials.

Nasal rhomboidal, longer than high, with naris centrally situated; nasals widely separated by frontonasal. Loreal one. Preoculars two. Superciliaries eight; first superciliary largest, in contact above with posterolateral edge frontonasal and (narrowly) with anterolateral edge frontal, in contact below with upper preocular and (narrowly) with loreal. Ciliaries 10/8; a small scale interposed above anterior ciliary and below suture between first two superciliaries. Scales (lower ciliaries) along edge of lower eyelid 15/12, the first lying posterior to suture between preoculars. Lower eyelid movable, scaly, with elongated median window (fig. 2). Subocular row incomplete, separated by fourth supralabial below center of eye, with three presuboculars and two postsuboculars. Several small pretemporals. Primary temporal one, separated from parietal by a pretemporal. Secondary temporals two, the lower larger than primary temporal. Six supralabials on each side.

Six infralabials on each side; mental more than twice as wide as long; postmental longer than mental, in contact with first two infralabials on each side; three pairs of enlarged chin scales, with first pair in broad contact, second pair separated by one scale row, third pair separated by three scale rows.

External ear opening a large vertically

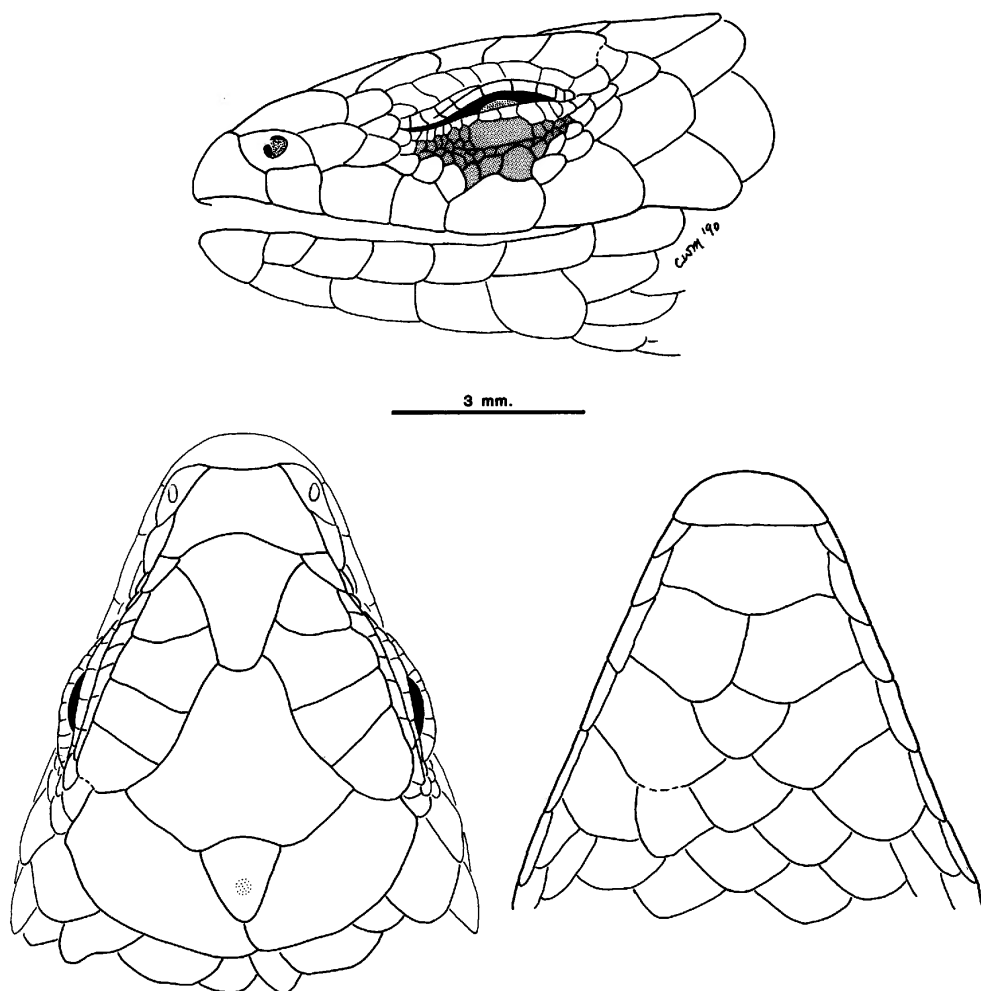


Fig. 2. Head of *Sphenomorphus rarus*, new species (AMNH 129836, holotype). Translucent (i.e., nonpigmented) scales of the lower eyelid are shaded gray.

aligned oval (smaller than eye opening), without lobules or spines. Scales smooth and unstriated, in 26 rows around midbody; 29 rows around neck just anterior to forearm; about 19 rows around base of tail. Paravertebral rows (from end parietals to midlevel between thighs) each with about 55 scales. Trunk scales nearly equal in size dorsally and ventrally. Scales of limbs smooth and unstriated as on body. Supradigital scales paired except for single distal scale; upper and lower ungual-sheath scales short, covering only base of claw; subdigital lamellae rounded. Digits short, as reflected in lamellae counts, as follows (Roman numerals = digits, Arabic numbers = subdigital lamellae on left/right feet):

Forefoot, I 3/4 II 5/6 III 7/7 IV 7/7 V ?/4.

Hind foot, I 3/3 II 8/7 III 9/11 IV 11/11 V 6/5.

Median pair of enlarged preanal scales (about $1.5 \times$ size of adjacent ventrals), each overlapping part of a smaller outer preanal scale on each side. Subcaudals on base of tail nearly as large as ventrals; subcaudals widened on regenerated part of tail.

COLOR PATTERN: In life (fig. 1) dark brown above, turning yellowish on lower sides; a black stripe from side of snout through eye and above ear, ending slightly posterior to shoulder, edged below by a pale yellow post-ocular stripe from eye to ear. Underside of head and throat gray save for a few flecks of

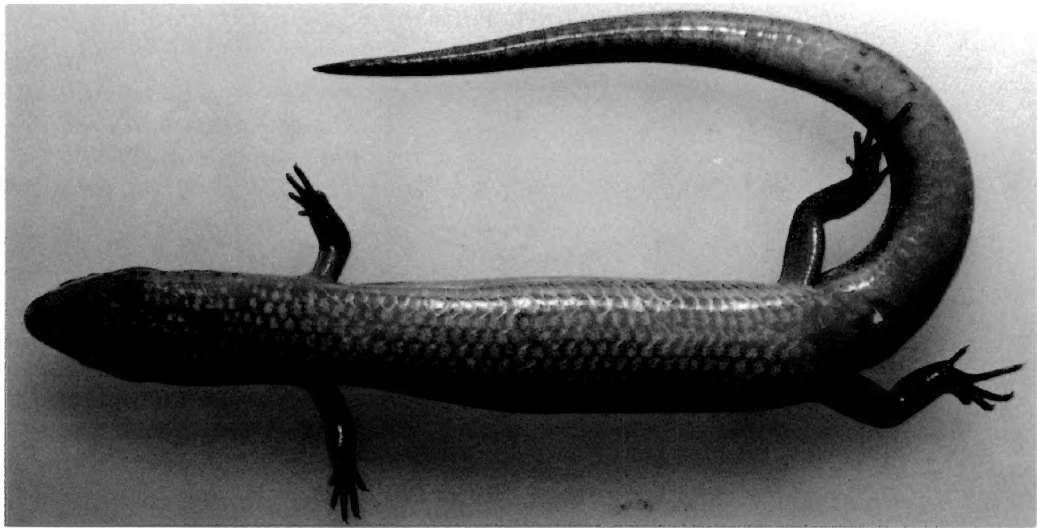


Fig. 3. Ventral view of holotype of *Sphenomorphus rarus*, photographed before preservation, about $\times 2$. The pale areas of pigmentation on throat and venter were golden yellow.

golden yellow, which becomes the predominant color of the venter (fig. 3); underside of tail gray, becoming blackish near the tip; undersides of limbs dull greenish yellow, palms and soles black. Iris dark brown. Notched tongue black above.

In preservative a lighter brown. Scattered melanophores between the anterior dorso-lateral black stripes become posteriorly coalesced, forming six poorly defined, dark, dorsal lines starting at level of forelimbs and extending posteriorly along body and onto tail (these lines barely evident in life). Supralabials and infralabials irregularly blotched and spotted with brown; side of neck and flanks pale, with dark brown spots and flecks (also evident in life, fig. 1). Limbs irregularly spotted, almost reticulated, in light and dark brown, this pattern more evident in preservative than in life. Ventral surfaces immaculate white, except undersides of feet and regenerated part of tail pale brown.

HEMIPENIS: The hemipenes were almost fully everted at time of preservation. The left organ was removed from the specimen, softened successively in glycerin and in a solution of trisodium phosphate, and reinflated with carmine-dyed petroleum jelly. The inflated hemipenis (fig. 4A) of the holotype is 9 mm long. It is a thin-walled, deeply bilobed structure, with the lobes comprising 44 percent of

the total length. The deeply entrenched sulcus spermaticus forks a short distance below the lobes (about 44% of distance from base) and the branches extend onto the lobes in a centrolineal orientation, terminating well below the apices of the lobes. The basal part of the hemipenis is widened in sulcate or asulcate view; a pronounced collarlike swelling below the lobes forms a distinct overhang on the asulcate side (but does not give the organ a "capitate" appearance). The distal part of each lobe bears two enlarged flaps of tissue, one rounded and one pointed, to the lateral side of each sulcus branch near its termination. The lobes of the hemipenis are strengthened by thick, elongated folds of tissue, which are somewhat variably arranged so that the lobes are not mirror images. The organ is spineless and lacks visible microornamentation at $\times 50$ magnification.

OSTEOLOGY: Based on an X-ray photograph, the phalangeal formula for the hand is 2-3-4-4-3 and for the foot 2-3-4-5-3. There are 26 presacral vertebrae including the atlas.

FIELD NOTE: The holotype was active during a sunny afternoon, in ground litter on a forested slope.

COMPARISONS

Sphenomorphus rarus needs be compared only briefly with *Sphenomorphus assatus*

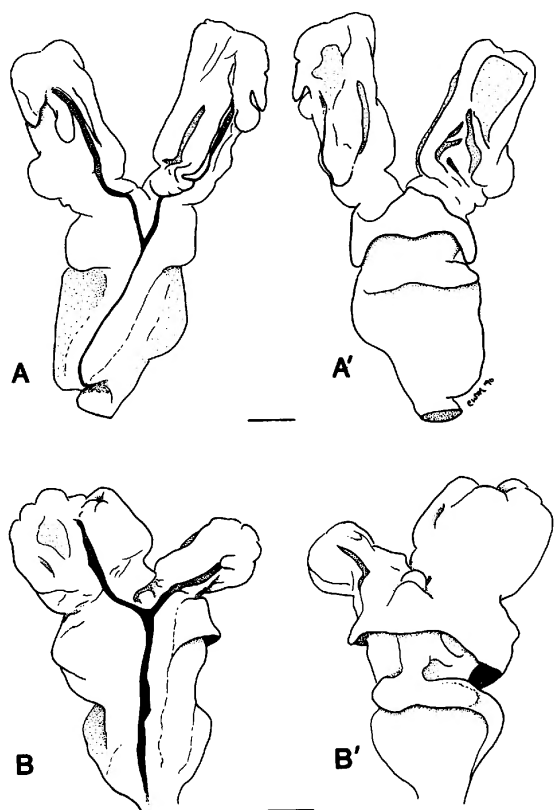


Fig. 4. Male genitalia of *Sphenomorphus* from lower Central America, shown in sulcate (left) and asulcate (right) view; $\times 9$ (scale lines = 1 mm). A. Fully everted left hemipenis of *S. rarus*, AMNH 129836, holotype (52 mm SVL), western Panama. B. Partially everted left hemipenis of *S. cherriei*, AMNH 104424 (55 mm SVL), Great Corn Island, Zelaya, Nicaragua.

(Cope) and *S. incertus* (Stuart) of southern Mexico and northern Central America. These two species somewhat resemble *rarus* in having a low number of midbody scale rows and relatively short limbs (usually nonoverlapping in adults), but they differ absolutely in the presence of prefrontals and two loreals, and in having ≥ 14 subdigital lamellae under the fourth toe. Judging from the literature and AMNH specimens of *assatus*, there may be other differences in scutellation as well as in proportions and color pattern, but variation within these taxa is not well known (see Stuart, 1940, and Greer, 1974: 33). One or more of the subspecies of *S. assatus* in Stuart's (1940) account might warrant specific status;

one of these (*cherriei*) currently is so regarded.

COMPARISONS WITH *SPHENOMORPHUS CHERRIEI*

As presently constituted, the third named species of New World *Sphenomorphus*—*S. cherriei* (Cope)—ranges from Veracruz, Mexico to Panama. It is a longer legged species than any of the others and has a higher number of midbody scale rows (30–36) according to Stuart's (1940: 5) treatment. The type locality of *cherriei* is in Costa Rica,³ the area that has provided the greatest number of museum specimens of this species. Costa Rican and Panamanian *cherriei* seem to resemble *rarus* somewhat more closely than do specimens from farther north. For these reasons, *rarus* is compared below mainly with specimens from southern populations of *cherriei*.

COSTA RICA: Since *Sphenomorphus rarus* shows a superficial resemblance to southern *S. cherriei*, a search (unsuccessful) for additional specimens of the new species was made in the extensive holdings of *cherriei* in the Costa Rican Expeditions (CRE) collection at the University of Miami. Initially, 223 specimens of *cherriei* were examined from 40 localities in seven Costa Rican provinces, as follows (province and number of localities followed by number of specimens in parentheses): Alajuela 3 (3), Cartago 4 (21), Guanacaste 6 (23), Heredia 4 (53), Limón 8 (51), Puntarenas 12 (68), San José 3 (4).

The above samples of *S. cherriei* provided information on variation in certain diagnos-

³ *Mococa cherriei* Cope (1893: 340–341), from Palmar [= Palmar Norte, Puntarenas Prov.], southwestern Costa Rica. Based on a single specimen later deposited in the American Museum (see Myers [1982: 23] for a brief history of Cope types at AMNH).

The holotype (AMNH 9551), a juvenile 24 mm SVL, is in poor condition but shows the following characteristics that are consistent with our current concept of *cherriei*: Prefrontals present, with intervening posterior margin of frontonasal straight; two loreals; nuchals undifferentiated; 32 scales around midbody; 18/17 subdigital lamellae under fourth toes; lower eyelid with window of two panes (anterior smaller); adpressed limbs widely overlapping (4th toe extending past hand to reach upper arm).

tic characters throughout the Costa Rican range. All 223 *cherriei* specimens had two prefrontals (absent in the *rarus* holotype). The posterior margin of the frontonasal (markedly concave in *rarus*) was more or less straight in 142 specimens (64%) of *cherriei*, convex in 78 (35%), and concave in but three (1%) of 223 specimens; one of these (CRE 849, Limón) is aberrant in having an azygous scale between the frontonasal, frontal, and prefrontals.

Of the above sample, 193 specimens have the lower eyelid closed enough to permit easy coding for presence or absence of a single median window (present in *rarus*): Only two (1%) *cherriei* have the median window (CRE 139E, Limón; CRE 2811A, Cartago), whereas 139 specimens (72%) have several small scales toward the center of the lower eyelid. An additional 19 (10%) of the *cherriei* specimens have a kind of window comprised of two equal or unequal "panes": 11 of these 19 have two panes of unequal size (anterior smaller) and eight have panes equal in size. The remaining 33 (17%) of 193 specimens show bilateral asymmetry in the lower eyelids, but none of these has a single median window.

THE LA SELVA POPULATION: The general Costa Rican sample of *S. cherriei* included 47 specimens from the La Selva Biological Reserve (2.6 km SE Puerto Viejo de Sarapiquí, Heredia Prov.) in northeastern Costa Rica. Subsequently, an additional 60 specimens were examined from this locality (6 juveniles, 2 females, 9 males, and 43 unsexed adults). These additional specimens were collected in 1972–1973 as part of a study of the dynamics of the leaf-litter herpetofauna (Lieberman, 1986; Guyer, 1986; Donnelly, 1989). Morphological variation summarized for this geographical and temporally well-defined population sample reinforces the morphological distinctions already made between Costa Rican *cherriei* and the Panamanian holotype of *rarus*, as follows:

	<i>Sphenomorphus rarus</i> (<i>N</i> = 1)	La Selva <i>S. cherriei</i> (<i>N</i> = 60)
Prefrontals	absent	present
Rear margin frontonasal	concave	≈ straight or convex
Anterior loreal	absent	present

Lower eyelid window(s)	single	two or more
Midbody scale rows	26	29–32, \bar{x} = 30.0, <i>SD</i> = 0.72
Paravertebral scale rows	55	60–67, \bar{x} = 63.9, <i>SD</i> = 1.91
Rows betw. adpressed limbs	10 ⁴	0–9, \bar{x} = 2.6, <i>SD</i> = 2.88
4th toe lamellae	11	13–18, \bar{x} = 15.8, <i>SD</i> = 0.93
4th finger lamellae	7	8–10, \bar{x} = 9.6, <i>SD</i> = 0.54

PACIFIC WESTERN PANAMA: A total of 13 specimens of *S. cherriei* are available from the Pacific lowlands of Chiriquí Province in extreme western Panama (ANSP 21628, 21774–21776, Puerto Armuelles; ANSP 21779–21787, Burica Farm, Chiriquí Land Co.). One of these is an adult female (ANSP 21628, 53 mm SVL) and the other 12 are juveniles (\bar{x} SVL = 27.4 mm, *SD* = 4.01). Variation in this sample:

Prefrontals	present
Rear margin frontonasal	straight (11) or undulating (1) ⁵
Anterior loreal	present
Lower eyelid windows	two to several
Midbody scale rows	30–32, \bar{x} = 30.8, <i>SD</i> = 0.56
Paravertebral scale rows	63–67, \bar{x} = 65.0, <i>SD</i> = 1.23
Rows betw. adpressed limbs	0–5 (0 in 11 juv., 2 in one juv., 5 in ad. ♀)
4th toe lamellae	15–18, \bar{x} = 16.7, <i>SD</i> = 0.96
4th finger lamellae	9–12, \bar{x} = 10.0, <i>SD</i> = 0.77

AN ENIGMATIC SPECIMEN FROM ATLANTIC WESTERN PANAMA: A single specimen of *Sphenomorphus* (AMNH 119063, fig. 5) is

⁴ This separation would be "–5" scales if indirectly calculated following Stuart's method (1940: 2–3), as follows: axilla-groin length [27 mm] – (forelimb [9 mm] + hind limb length [15 mm]) = 3 mm, a distance containing 5 lateral midbody scales in the holotype of *S. rarus* (52 mm SVL). For 24 specimens of *cherriei* over 49 mm SVL, Stuart (loc. cit.) gave a range of from –1 scale (one specimen with limbs failing "to meet") to +12 scales (\bar{x} = +5 scales in "leg overlap"). On Stuart's plot for 75 *cherriei* and 39 *assatus* of all sizes, the holotype of *rarus* would thus fall well outside the total range (–1 to +24 scales) for *cherriei*, but near the midpoint of the range (0 to –9, \bar{x} = –4 scales) for equivalent-sized *assatus*.

⁵ Another specimen (ANSP 21785) is aberrant in having the frontonasal plate comprised of two asymmetric scales (the left wider than the right), with the posterior border being concave at the junction of these scales.

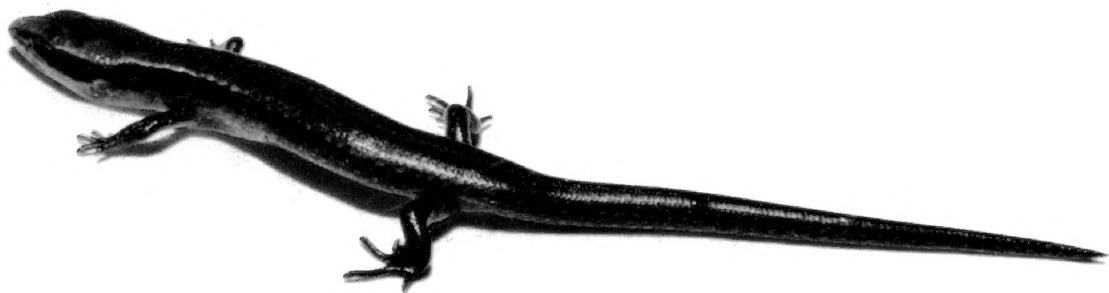


Fig. 5. *Sphenomorphus cherriei* (Cope), in life. A juvenile (AMNH 119063) from Río Changuinola near Quebrada El Guabo, 200 m, Bocas del Toro lowlands on Atlantic side of extreme western Panama; approximately $\times 2.7$.

known from the Atlantic side of extreme western Panama, from forest at an elevation of 200 m. It shows a curious mix of characters but unfortunately is a small juvenile of only 24 mm SVL: prefrontals present; rear margin frontonasal nearly straight (slightly concave); anterior loreal absent; lower eyelid windows single; midbody scale rows 28; paravertebral scale rows 55; rows between adpressed limbs about 8; 4th toe lamellae 15/14; 4th finger lamellae 8.

The presence of prefrontals and relatively high number of fourth toe lamellae seem to place this interesting specimen with *S. cherriei*, whereas the single palpebral disk (in $< 1\%$ of *cherriei*), number of paravertebral rows, and absence of the anterior loreal are in agreement with *S. rarus*. Radiographs of the hand and feet are unsatisfactory, being very poorly resolved (presumably because some phalanges are incompletely ossified). One interpretation yields the hand/foot formulae of 2-3-4-4-2/2-3-4-5-2, which, if correct, is suggestive of a third species in lower Central America. But not too much should be made of isolated juveniles, which sometimes show variations not normally present in survivors to adulthood. We provisionally assign this specimen to *S. cherriei*, which, because of its proximity in Atlantic-side Costa Rica, was to be expected on the north coast of western Panama. A final judgment must wait for additional material.

HEMIPENIS: Unsuccessful attempts were made to inflate incompletely everted hemi-

penes from several preserved *Sphenomorphus cherriei*. These partial eversions permit comparisons between the basal (unbifurcated) halves of the hemipenes of *rarus* and *cherriei*. The *cherriei* examined included two from Great Corn Island, off the Atlantic coast of Nicaragua (AMNH 104422, 104424), and two from La Selva, on the Atlantic side of Costa Rica (CRE-USC 1055, 1555).

See figure 4 for the completely everted hemipenis of *S. rarus* and the best eversion obtained for *S. cherriei*. The asymmetrical configurations of the lobes of the *rarus* hemipenis suggest the possibility of considerable variation on this part of the organ; careful field eversions (best done under magnification with a water-filled syringe) of a number of the relatively common *cherriei* might be the easiest way of getting possible insight on this point. Meanwhile, the material at hand indicates topographical constancy on the unbifurcated basal part of the hemipenis in *cherriei*.

The hemipenes of *S. cherriei* and *S. rarus* are generally similar but the basal part of the organs appear to differ in three respects: (1) In *rarus* the sulcus spermaticus divides below the crotch of the hemipenis (fig. 4A), whereas it is essentially at the crotch in two *cherriei* in which the point of division could be seen (fig. 4B). (2) The transverse collarlike swelling below the hemipenial lobes in *rarus* has a basal overhang that is relatively shallow and closely adherent to the body of the organ (fig. 4A, A'). The homolog of this structure in

cherriei has a deeper and widely flared overhang, giving the organ a distinctly capitate appearance (fig. 4B, B'). (3) As viewed from the sulcate side, in *S. rarus*, the lateral basal expansions on the sulcate side (fig. 4A) are weakly swollen ridges that rise distally to become joined on the asulcate side by a weak transverse ridge (fig. 4A'). The homolog in *S. cherriei* is more pronounced, resulting in a much stronger transverse asulcate ridge, from which a weaker ridge is produced distad toward the capitate overhang (fig. 4B').

Thus, hemipenial differences between Panamanian *Sphenomorphus rarus* and Nicaraguan and Costa Rican *S. cherriei* seem to support our conclusion that the unique specimen of *rarus* represents a different species.

PHALANGEAL FORMULAE: Differences in number of phalanges also support the recognition of *S. rarus*. Comparisons of X-ray photographs of the holotype and of three adult male *S. cherriei* from Costa Rica show *S. rarus* with one less phalanx in the fourth finger and one less in the fifth toe. The hand/foot formulae are otherwise the same, as follows (*rarus* in parentheses, where different): 2-3-4-5(4)-3/2-3-4-5-4(3).

COMPARISONS WITH OTHER LIZARDS

The only other genus of true skinks in Panama is *Mabuya*, readily distinguished from all New World *Sphenomorphus* by larger size and the presence of supranasals and paired frontoparietals. Other shiny-scaled, skinklike lizards in Panama belong to the families Anguidae and Teiidae (microteiids only). A small brown anguid, *Diploglossus bilobatus*, occurs microsympatrically with *Sphenomorphus cherriei* in Costa Rica and in the Atlantic lowlands of western Panama (e.g., AMNH 119015-16, from the same locality as the peculiar juvenile *S. cherriei* described above), but it differs in numerous respects, including sheathed claws, supranasals, prefrontals in contact, a single large frontal (no frontonasal), and small, paired frontoparietals. See Myers (1973) for a key to the three genera and five species of anguids occurring in Panama.

Seven diverse genera of microteiids are found on the Isthmus of Panama. Four of

these (*Echinosaura*, *Leposoma*, *Prionodactylus*,⁶ and *Ptychoglossus*) cannot possibly be confused with *Sphenomorphus* because they have strongly keeled or tuberculate scales, with the dorsals and ventrals differing in shape. The three smooth-scaled genera, each with a single representative in western Panama, can be easily distinguished from New World *Sphenomorphus* as follows: The arboreal *Anadia (ocellata)* has an exceedingly long tail, lateral ocelli, and quadrangular dorsal and ventral scales in transverse rows. The semifossorial *Bachia (blairi)* has hexagonal dorsal and quadrangular ventral scales and reduced limbs bearing fewer than five toes (four on forefoot, three on hind foot). *Gymnophthalmus (speciosus)* is the most skinklike of the Panamanian microteiids, since it has smooth, shiny, dorsal and ventral scales that are imbricate and tending to be posteriorly rounded. But it differs from Panamanian skinks in numerous characters, including a low number ($\approx 13-15$) of midbody scale rows and four rather than five toes on the forefoot; it also lacks movable eyelids. In this last character, *Gymnophthalmus* differs also from all other Panamanian microteiids.

ECOLOGICAL GEOGRAPHY OF NEW WORLD *SPHENOMORPHUS* AT THE SOUTHERN END OF THE RANGE

A few authors (e.g., Peters and Donoso-Barros, 1970: 155) have listed *cherriei* as occurring south "to Panama." Stuart (1940: 5), without going into details, mentioned the existence of "a large series of specimens [of] *Lygosoma assatum cherriei*" from Chiriquí in Panama." Stuart evidently referred to the ANSP specimens obtained by E. R. Dunn and discussed above under Pacific Western Panama. Dunn (1931: 17) himself, however, in a probable lapse of memory, seems to have erred in listing "*Leiolopisma assatum*" from central Panama. Until recently, Dunn's ma-

⁶ This genus barely enters eastern Panama: *Prionodactylus vertebralis* is known only from 1400-1410 m on Cerro Malí (AMNH 119368-70, KU 76174-75), and from 1540-1660 on Cerro Tacarcuna (AMNH 119367)—both localities very close to the Colombian border.

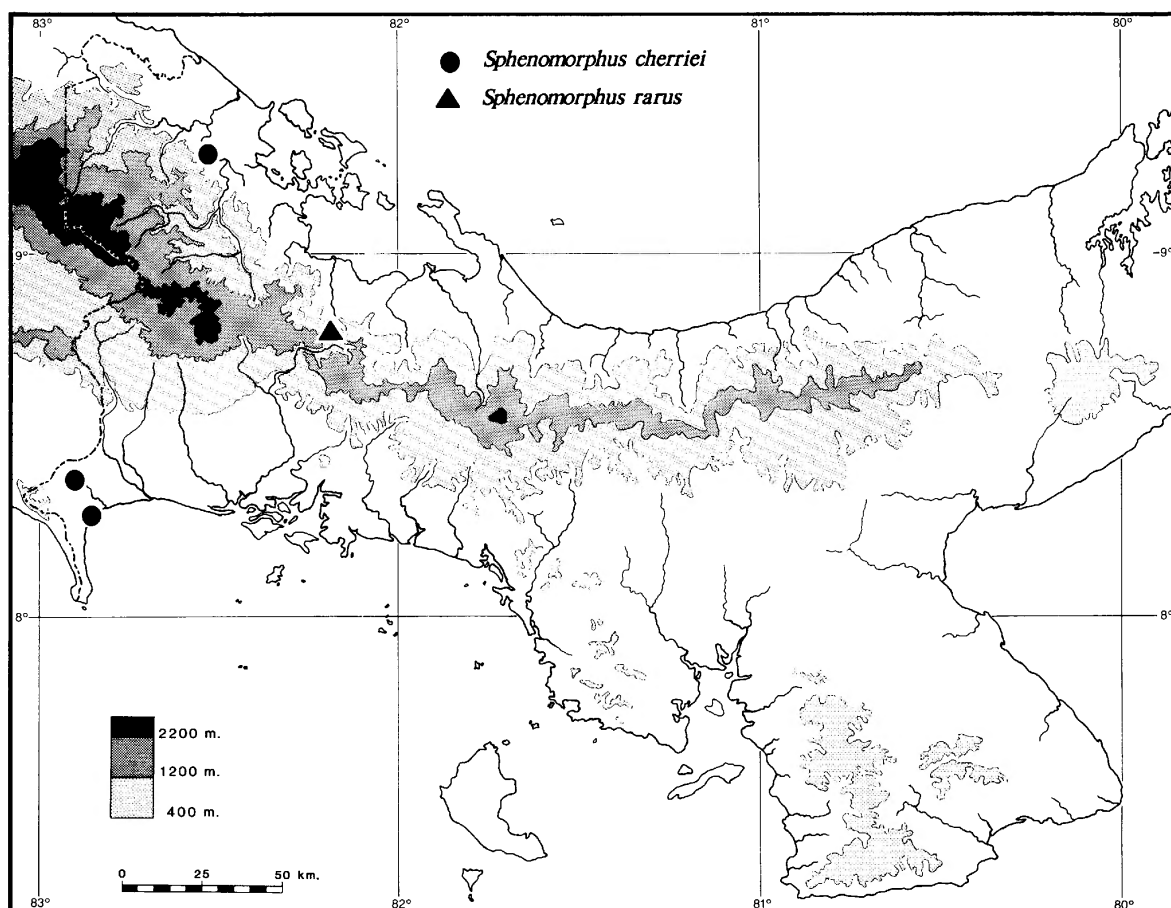


Fig. 6. Western Panama, showing locality records for *Sphenomorphus* (sensu Greer) at the southern end of the New World range.

terial from the Puerto Armuelles region on the Pacific side of extreme western Panama seems to have been the only valid basis for including *cherriei* in the Panamanian fauna.

The only additional Panamanian specimen of *cherriei* known to us is the juvenile specimen tentatively assigned to that species from the north coast. Based on these few records, the range of *Sphenomorphus cherriei* extends out of Costa Rica along both coasts into the lowlands of extreme western Panama (fig. 6); it is a lowland rain-forest distribution. These southernmost records of *cherriei* may well be near the terminus of its range, although, based on gross habitat, the range on the Atlantic coast might be expected to extend farther east along the foothills for another 100 km or so. In contrast, much of the lowland wet forest on the Pacific side has been turned to pasture

and farmland in the last half century and was less extensive to begin with, being essentially a short eastward extension of the Golfo Dulce rain-forest region of southwestern Costa Rica. Less suitable (drier) lowland habitat occurs to the east of this region.

Sphenomorphus rarus extends the New World range of the genus south and east nearly to the 82nd meridian, in the central highlands of western Panama (fig. 6). The type locality is on the Atlantic versant in lower montane rain forest at 780 m elevation. The one elevational record is equivocal: *S. rarus* may prove to be a lowland species sampled near the upper end of its elevational range, although we suspect that it is an upland species. Various kinds of upland distributions are represented by endemic elements of the herpetofauna in the general region. For ex-

ample, the poison frog *Dendrobates speciosus* occurs in a restricted area of wet forest at 1140–1410 m above sea level (Edwards et al., 1988), whereas *D. arboreus*, essentially a highland species, descends nearly to sea level (Myers et al., 1984); both of these are locally abundant in a narrowly zoned east-to-west distribution. But *Sphenomorphus rarus* is more reminiscent of the snake *Hydromorphus dunni*, a valid species still known only from the holotype collected half a century ago (Savage and Donnelly, 1988).

The type locality of *Sphenomorphus rarus* is little over 1 km north of a low section of the continental divide, where wet climatic conditions of the Atlantic versant spill over into the upper valley of the Río Chiriquí of the Pacific side. Thus, the only known locality for *S. rarus* lies essentially between the eastern (southern) end of the Cordillera de Talamanca and the western end of the Serranía de Tabasará (see Myers and Duellman, 1982: 12–14, for geography of this region). It is an ambiguous point from which the distribution might extend in either direction or both.

ACKNOWLEDGMENTS

The new lizard was collected in early 1983 near what is now the transisthmian highway from Gualaca on the Pacific side of Panama to Chiriquí Grande on the Atlantic coast. The Atlantic-slope side of this road, then being built by Constructora Urbana, S.A. (CUSA), was at that time only a muddy bulldozer track. For allowing access to the construction area, and for use of facilities in CUSA road camps, grateful acknowledgment is due Ing. Alberto Alemán III, Ing. Rafael Alemán, and Ing. Edgar Hernández. The senior author's fieldwork, part of an ecological assessment of the transisthmian oil pipeline, was greatly facilitated by Dr. Pedro Galindo of the Gorgas Memorial Laboratory, Dra. Fiorella De Vincenti de Ciniglio of Estudios Ambientales, S.A., and by Ing. José Arosema III, General Manager of Petroterminal de Panamá. Special thanks to all.

For access to specimens in their care, we are grateful to Mr. Edmond V. Malnate, Academy of Natural Sciences of Philadelphia (ANSP), Dr. William E. Duellman, University of Kansas Museum of Natural History

(KU), and Dr. Jay M. Savage, Costa Rican Expeditions collection (CRE), University of Miami. For reading the manuscript, we thank Drs. Allen E. Greer, Hobart M. Smith, and Richard G. Zweifel.

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⁷ There is some library evidence that this part of volume 31 of the *Proceedings* did not appear until February 1894, in which case new names in Cope's paper will date from a preprint to which the line has been added (bottom p. 347) "Reprinted Dec. 30, 1893 . . ."

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